METHODS OF PROTECTION FROM MOSQUITOES BLACK-FLIES AND SIMILAR PESTS IN THE FOREST. By M. B. Dunn.

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METHODS OF PROTECTION FROM MOSQUITOES, BLACK-FLIES AND SIMILAR PESTS IN THE FOREST

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INTRODUCTION

The number of persons entering Canadian forests on business or pleasure shows a steady annual increase. Lumbermen, miners, tourists, hunters and fishermen, each year visit more remote sections of the country. Many, however, are deterred from entering the woods during the spring and summer months through apprehension of the extreme discomfort and annoyance they may be caused by the attacks of mosquitoes, black-flies and other insect pests. It is unfortunately true that during these months such insects are usually abundant in almost all sections of the forest and even hardy and experienced woodsmen at times suffer great inconvenience as a result of their attacks. A strict adherence to certain simple precautionary measures, however, will do much to mitigate the extreme discomfort caused by these winged pests and make it possible for almost anyone to visit the woods during the summer months.

THE CHIEF BLOOD-SUCKING INSECTS OF THE FOREST

The common insect pests attacking man in the northern woods are nearly all of the order Diptera or two-winged flies. Those usually present in abundance are various species of mosquitoes of the genus *Aedes;* black-flies of the genus *Simulium;* midges, sand-flies, punkies or "bite-um-no-see-ums" of the genus *Ceratopogon;* "deer-flies", "moose-flies" or "dog-flies" of the genus *Chrysops* and horse-flies or "bull-dogs" of the genus *Tabanus.* Of these the black-flies and mosquitoes are usually by far the most numerous and annoying. The mouth parts of all these insects are somewhat alike and are arranged as a number of blades or spikes, loosely encased in the long, slender labium or lower lip, and forming an efficient piercing organ known as the proboscis. This is thrust into the skin of the victim and blood rapidly withdrawn by means of suction. At the same time a quantity of a powerful irritant poison, secreted by the salivary glands, is discharged into the wound, causing the irritation and swelling usually resulting from such an insect's attack.

PERIOD OF GREATEST ABUNDANCE

The period of greatest abundance varies considerably in accordance with latitude and the character of the spring season. As a general rule, however, mosquitoes become sufficiently abundant in the forests of Eastern Canada to cause serious inconvenience soon after June 1 and their numbers increase rapidly until the end of the month. Subsequent to July 15 they are noticeably less abundant and after August 1 will not usually cause much trouble. Mosquitoes are active both day and night, but are the most persistent and vicious in their attacks between daylight and nine o'clock in the morning and between five and ten o'clock in the evening.

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Black-flies are usually abundant several days earlier than mosquitoes and reach their maximum numbers about July 5. They have practically disappeared in some sections by August 15, but in others are exceedingly numerous until well into October. It is, therefore, wise, unless one is familiar with the district he proposes to visit, to be prepared for the attack of black-flies until October 15. Black-flies are strictly diurnal and do not attack between dusk and daylight.

Midges or punkies are numerous at approximately the same time as mosquitoes, but are much more spasmodic in their occurrence and abundance. Owing to their minute size, their habit of entering the clothes and biting all parts of the body, and the extreme irritation of the skin resulting from their bite, they are, when very numerous, one of the most serious pests of the woods. They attack at all times of the day and night, but are usually worst between daylight and sunrise.

Deer-flies and horse-flies are most abundant on hot days in June, July and August. These insects are not usually sufficiently numerous to become a source of serious discomfort. They cause considerable annoyance, however, by their habit of buzzing rapidly and persistently around one's head in hot weather, and their occasional bites are painful. They are all diurnal and cause no trouble between sunset and sunrise.

LOCATIONS OF GREATEST ABUNDANCE

As is commonly known, mosquitoes breed in still water and are, therefore, usually very abundant in the vicinity of swamps, meadows and other undrained areas, while in high hardwood or pine land they are generally much less numerous.

Black-flies breed in shallow running water, the larvæ clinging to the rocks in the bottom of the stream. The larvæ of some species of midges live under the bark of decaying branches, under fallen leaves, etc., but most of them live in still or running water. Insects of both these genera will be found generally abundant, but they are usually present in greatest numbers around water. Midges are frequently very numerous in grassy areas.

METHODS OF PROTECTION FROM ATTACK

Proper Camping Sites

In seeking protection from attack, great care should be exercised in the selection of camp sites. If possible, camp should never be made near marshes, swamps, meadows or pools of stagnant water. It is also well to avoid heavy woods and dense underbrush which entirely break the wind, as the latter is of considerable aid in keeping the insects at a distance. A dry, open space in the forest or on some fairly exposed promontory (See fig. 1) unless the wind be so strong as to threaten the collapse of the tents, will be found suitable. On the larger lakes, small islands with few trees and a mile or more from shore, are often entirely free from mosquitoes and thus make ideal camping sites. Avoid the grassy spaces in the yards of old lumber camps, for from this grass punkies often rise in myriads. Driving dams on streams or at the outlet of lakes furnish ideal breeding places for black-flies, which are usually extremely abundant in the vicinity of such places. The latter should, therefore, always be avoided.

When leaving camp by canoe one generally is followed from the lake shore by a swarm of mosquitoes and black-flies. If a breeze is blowing it will usually be found profitable to paddle vigorously against it for a few minutes, even if such a procedure takes one off one's course, as most of the insects will be blown to such a distance that they will not return to the attack and relief from them will be had for some time.

When upon a canoe or other trip on which the camp is moved daily, it is well to make camp on the first favourable site met with after four o'clock in the afternoon. The erection of the tent should be the first matter attended to, thus obviating the danger of having this task to perform after dark when, with the mosquitoes abundant, it becomes a very difficult one.

Fly-proof Tents and Shelters and Their Proper Erection

A fly-proof tent is the one really effective means of protection from insect pests. Unless the mosquitoes and black-flies are unusually numerous and voracious, the average person can manage in some manner to endure them during the day, but when, after days of hard paddling or portaging, one is compelled to lose nightly many hours of needed sleep through their attacks, life becomes most miserable and health itself is menaced. Within a properly erected fly-proof tent, however, one can be completely immune from attack no matter how numerous the insects may be.

A good fly-proof tent must have a complete cloth floor or a sod cloth extending inward from the edge of the tent not less than one foot. It must also have a strong cheesecloth or fine-mesh bobbinet curtain in the front (see figs. 1 and 2), which should be long enough to allow a considerable portion to be turned in at the bottom and full enough so that it will be still quite slack when the tent is erected. The back of the tent should always have a fine-mesh bobbinet window as the front curtain interferes materially with ventilation. The tent itself must be without the smallest hole or rip. Ordinary cotton "mosquito bar" is not suitable for the curtain and window, for punkies go through it easily and when numerous will soon render the tent uninhabitable.

For one-night camps the common "A" or wedge tent (see fig. 1) is the best as it can be very quickly erected, respite from the flies thus being obtained in the minimum length of time. For more permanent camps the wall tent (see fig. 2) with its much greater commodiousness, is more suitable. A very excellent style of tent with a door and cheesecloth curtain at each end is now obtainable. This gives the advantage of maximum ventilation.

When the tent is erected, several stones or heavy objects should be placed on the sod-cloth to hold it in position. Earth and ground litter from the inside of the tent should then be heaped on the sod-cloth until every crevice between the cloth and the ground is completely covered. This operation should be given the greatest care, for upon the thoroughness with which it is done depends to a very large extent the success of making the tent fly-proof. Sand, if it can be obtained, is the best material for this purpose as its weight will press the sod-cloth firmly to the ground and hold it well if the wind rises. Plenty of it should be used, several large pailfuls being required to hold down properly the sod-cloth of a 7 by 9 tent. If sand is used, a large pailful should be placed in reserve in the tent. If the tent is to remain erected for some time, the material used to hold down the sod-cloth should be as dry as possible in order not to rot the latter.

When the tent is erected, the front curtain should at once be dropped and as soon as the sod-cloth is covered, the front flaps should be fastened and the tent not entered except when absolutely necessary, since every time the front curtain is lifted a certain number of mosquitoes are likely to enter the tent. When ready to enter the tent for the night one should secure a large balsam bough and vigorously fan the mosquitoes away from the front of the tent, at the same time brushing the punkies from one's clothing. The tent flaps should then be thrown back and entrance made into the tent as quickly as possible, the bottom of the fly curtain being pulled in slightly and the spare pail of sand spread over it to hold it down. As in the case of the sod-cloth the greatest care should be taken to see that every crevice is covered, particular attention being

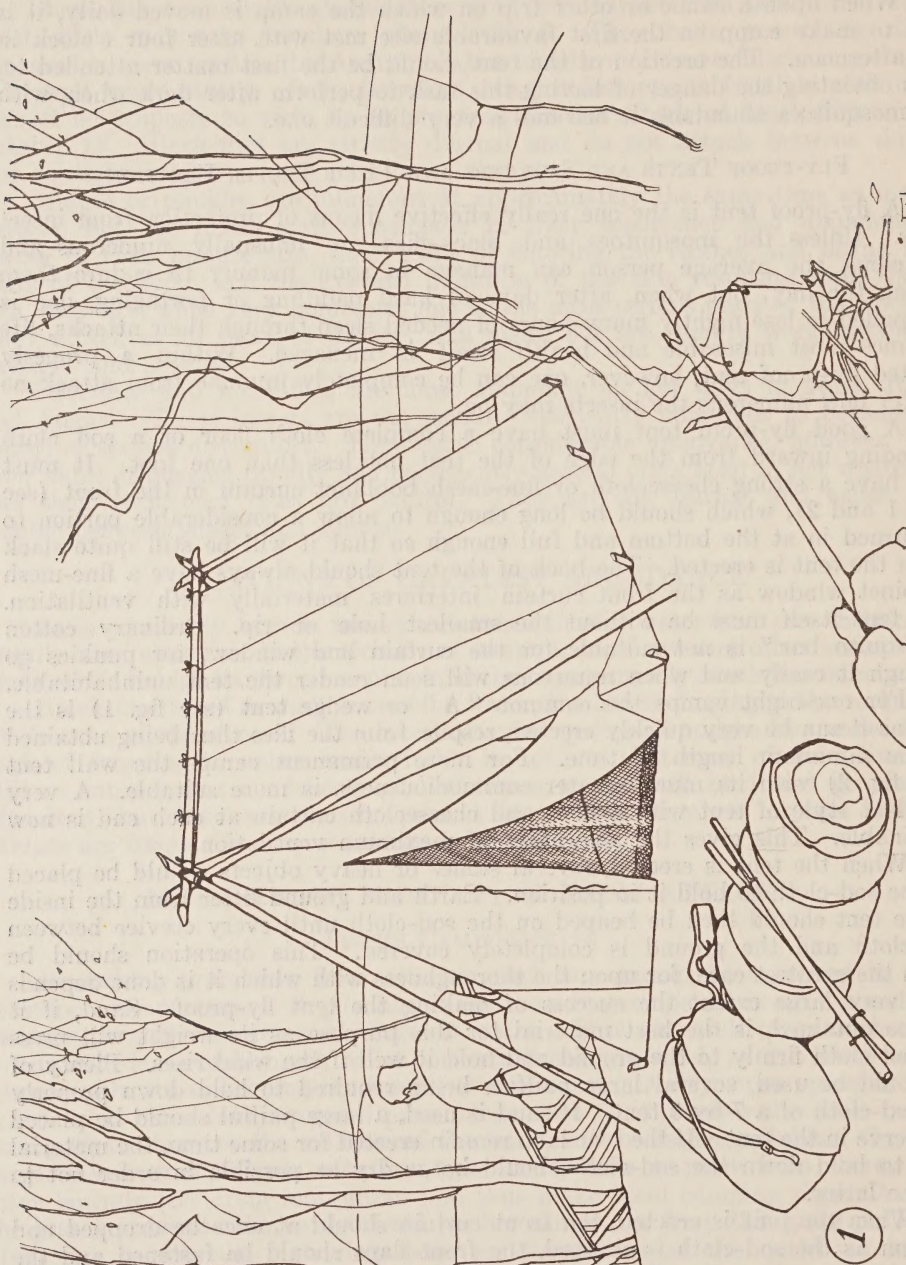

FIG. 1.—Ordinary "A" or wedge tent with fly curtain dropped.

FIG. 2.—Wall tents with different types of fly curtains.

paid to the corners, just where the fly curtain meets the side of the tent, since small openings are very likely to develop there. Where the ropes controlling the window cover and those holding the tent to the pegs enter the tent there are likely to be small gaps between the rope and the cloth. These should be carefully filled up with spills of paper or leaves. When this has been done the few insects which gained entrance when the fly curtain was lifted should all be killed. This can be done most easily by crushing them against the sides of the tent. If all these details are properly attended to, one can pass the night in comfort, but if the smallest hole is left open, mosquitoes and punkies will inevitably find it and enter.

For tents which are made with cloth bottoms, the front curtain is often fastened at the bottom to the floor of the tent, a large oval cut being made for the doorway (see B, fig. 2) which is closed by a puckering piece drawn together like the mouth of a bag. When not needed this piece can be tied back the size of the oval. Some campers prefer a complete tent lining or separate structure of cheesecloth the shape and size of the tent. This is supported from the ridge and tied out to the four corners, the front being lifted to gain entrance. This is an efficient device, but has the disadvantage of having a very large area of cheesecloth, thus being more likely to develop holes.

Another convenient arrangement is the "mosquito canopy" (see fig. 3). This is made in tent style with a duck or drill roof and cheesecloth sides. It has the advantage of allowing maximum ventilation, but also the drawback of a large area of easily torn cheesecloth.

Another useful arrangement for a wall tent is an inner wall of cheesecloth extending all around the tent. This is fastened down in the same manner as a sod-cloth and the tent wall proper may then be rolled up for ventilation.

If the tent used is a large one with several persons sleeping in it, the entrance of a considerable number of mosquitoes is almost inevitable owing to the necessity of frequently raising the front curtain. Under these circumstances individual bed-bars or canopies are probably the most useful arrangement. These should be made of cheesecloth about 7 feet long, 4 feet wide and 4 feet high. They should have tapes at the corners for suspending them over the bed. One or two light poles can be erected over the bed, supported by crossed or forked sticks in the same manner as tent poles and the canopy suspended from these. Upon retiring, one should carefully tuck the edges of the canopy as far as possible under the lower bedding, making certain that not the slightest opening is overlooked. The sides of the curtain should be as taut as possible as this will give the maximum ventilation.

It can hardly be emphasized too greatly that with all these devices the greatest pains should be taken to see that not the smallest opening is neglected. If one crevice is left open all the care expended upon the remainder of the sod-cloth or canopy will be of little avail, for when mosquitoes are shut out by a curtain they search it carefully for an entrance hole, and if the smallest one exists, numbers of them will surely find it.

The Use of Smudges

Smudges, when properly used, are of great assistance. To be effective for any length of time, however, they must be correctly built. The beginner usually makes too small a fire before adding the smoke-producing material, with the result that the fire goes out completely within a few minutes and produces no more smoke. Properly built, a smudge should last an hour. An area several feet square should be cleared of debris and humus and the mineral soil exposed. A bright fire should then be started and several fair sized sticks of dry wood added. This should be allowed to burn until a considerable bed

FIG. 3.—Mosquito canopy. In addition to protection from insects, maximum ventilation is secured.

of bright embers has been formed. While it is burning one should gather more dry wood and a large heap of green ferns, leaves, shrubs, damp leaf mould, rotten wood or other debris from the forest floor. Several pieces of dry wood should be then placed on the fire and allowed to become well ablaze, the whole then being covered with part of the damp material previously collected. A dense smoke will result immediately and will continue for some time, needing no further attention than an occasional additional supply of damp material or a few drops of water if the underlying fire gets too hot and bursts through the smoke-producing material as a blaze.

Smudges which are to be used in a tent or camp should be made in a metal pail or pot in the same manner as the above, the fire being of course much smaller. Pail smudges are also very useful out-of-doors as they can be moved in accordance with the vagaries of the wind. In making a smudge on the ground always take cognizance of the direction of the wind. In calm weather it frequently pays to make two or three smudges and occasionally billow the smoke about with a sheet of birch bark. Smudges are especially useful at mealtimes as they enable one to eat in comparative comfort. They can also be used to drive the mosquitoes from a tent or camp. In doing this the smudge pail should be placed in the part of the tent farthest from the door, the smoke being billowed to the roof and in the direction of the door with a towel or bit of bark. The mosquitoes will move ahead of the smoke and if the door be presently opened for a few moments most of them can be driven out. This process has to be repeated about every hour, however, unless the tent or camp be very tight.

Smudges are hard on the eyes and often are not used on that account. They are very effective, however, and when the flies are very numerous, nothing will give such a measure of relief in so short a time. Many old woodsmen depend entirely upon smoke to combat the insects. Great care should always be taken to see that a smudge fire is as completely extinguished as any other camp fire. When using a pail smudge in a tent the fire must be sufficiently smothered to prevent sparks rising, for if sparks come in contact with the cheese-cloth they will burn holes in it almost instantly.

A smudge is the best emergency measure which can be taken against these insects. It sometimes happens, through the capsizing of a canoe in the rapids. the destruction of the tents by fire or some other misfortune, that the most of a camper's outfit is lost and he is faced with at least one night in the bush with little or no protection from mosquitoes. If matches are carried, however, as they always should be, on one's person in a waterproof box, a smudge can soon be started. With this protection from the insects and a shelter constructed of the upturned canoe, if such be still available, and some balsam and spruce brush, one can pass a fairly comfortable night and be in much better condition next morning to face the difficult problem of getting safely out of the wilderness without an outfit, than if subjected to the unceasing torment of mosquitoes throughout the night.

Headnets, Veils and Gloves

Various forms of headnets and veils to protect the face and neck are in common use. A good headnet should be made of fine-mesh bobbinet, and be large enough to allow the wearing of a felt or straw hat. It should be long enough to extend well down over the shoulders and weighted around the bottom with shot sewn into a canvas pocket. It should also have three or four circles of whalebone or wire inside the bobbinet which, while allowing the net to collapse when not in use, hold it in cylindrical form when worn. Headnets are often very useful and it is well to include one in the list of equipment for a summer trip. Entire dependence should not be placed upon them, however,

as they are very uncomfortable in hot weather, considerably obstruct the vision and are very easily torn in brush. Moreover, unless the net fits very tightly at the bottom, black-flies are almost sure to crawl underneath it and when many of them do this, the net is worse than useless.

A considerable measure of protection is afforded the back of the hands and wrists by the use of old kid gloves. The forefinger and thumb may be cut out of the right hand glove in order to facilitate the manipulation of small instruments or articles such as fishhooks.

Proper Clothing

Black-flies and punkies have the habit of crawling inside the clothing and biting all parts of the body, while mosquitoes will bite through one thickness of any ordinary clothing, such as a flannel shirt, wherever the material touches the skin. A suit of light underwear should be always worn, therefore, as this renders it much more difficult for the insects to cause annoyance in the above manner. If the black-flies are very numerous, the shirt should always be kept buttoned, a large handkerchief worn around the neck, covering the shirt collar, the shirt sleeves closely buttoned and preferably held with a small elastic band, and the trousers tucked inside the socks or long boots and held tightly at the waist with a belt. If possible, braces or suspenders for the trousers should be discarded in favour of a belt as they hold the shirt close to the back and allow the mosquitoes to bite with ease.

Protective Mixtures or "Dopes"

Various essential oils applied to the skin are of great value in warding off attack. None that have yet been evolved are entirely effective, but several are of great value, especially when the insects are very numerous. Their continuous presence upon the skin is somewhat unpleasant, but this discomfort is soon forgotten as one experiences the marked relief due to their application. When the insects are abundant, it is usually necessary to apply "dope" at least once every half hour. Liberal quantities should be used and distribution over the hands and face should be thorough, as mosquitoes will alight upon any untreated portion of the skin. The more solid mixtures with a base of wax, soap or grease are more effective than liquid ones as they are not so rapidly removed by perspiration and the essential oils do not volatilize so quickly.

Great hardship is often experienced as a result of starting upon an extended trip in the woods with an insufficient quantity of protective mixture. Inexperienced campers often assume that a two or three-ounce bottle of "fly-dope" is a sufficient quantity for a small party during a week's trip. When mosquitoes and black-flies are in their usual summer abundance in the northern woods an ounce per person per day is the minimum amount necessary and more than this is often required.

Numerous patent protective mixtures composed of one or more essential oils combined with some heavy oil or grease are obtainable at drug stores. The majority of these preparations are quite effective, but are usually rather expensive, and equally good or better ones can easily be made by the individual at a lower cost. The following mixtures have been used by the writer and found valuable, No. 1 being apparently slightly more efficient than the others:—

No. 1

Oil of Citronella	3 oz.
Spirits of Camphor	1 oz.
Oil of Tar	1 oz.
Oil of Pennyroyal	$\frac{1}{4}$ oz.
Castor Oil	4 to 6 oz.

(Depending on the sensitiveness of the skin.)

No. 2

Oil of Citronella	2 oz.
Castor Oil	2 oz.
Oil of Pennyroyal	$\frac{1}{8}$ oz.

No. 3

Oil of Tar	2 oz.
Castor Oil	2 oz.
Oil of Pennyroyal	$\frac{1}{8}$ oz.

No. 4

Gum Camphor	3 oz.
Salol	3 oz.
Petrolatum	4 oz.

The purpose of the castor oil in mixtures, 1, 2, and 3 is to prevent injury to the skin by the essential ingredients. The amount may be varied to suit the individual requirement and should be as small as possible in comparison with the amounts of the other substances. Tallow may be used in place of castor oil with the above mixtures if one wishes to have the " dope " in the form of a salve or grease.

Dr. L. O. Howard, in *Remedies and Preventives against Mosquitoes,* Farmers' Bulletin No. 444, United States Department of Agriculture, gives the following as the most efficient protective mixture he has used:—

Oil of Citronella	1 oz.
Spirits of Camphor	1 oz.
Oil of Cedar	$\frac{1}{2}$ oz.

(Although this formula does not state that the use of castor oil or other base is necessary, its use is advisable, as without it the above mixture might prove injurious to the skin of some individuals.)

Dr. Howard also recommends the following:—

Oil of Lavender	1 oz.
Alcohol	1 oz.
Castor Oil	1 oz.

Bacot and Talbot in *The Comparative Effectiveness of Certain Culicifuges under Laboratory Conditions,* Parasitology, Vol. XI, No. 2, February 28, 1919, give the results of experiments with numerous protective mixtures and recommend the following, given in the order of efficiency:—

No. 1

Oil of Cassia	1 oz.
Camphorated Oil	2 oz.
Vaseline	3 oz.

No. 2

Oil of Peppermint	1 oz.
Oil of Cassia	2 oz.
Vaseline	2 oz.

No. 3

Oil of Turpentine	2 c.c.
Paraffin Wax	3 grs.
Vaseline	1 gr.

No. 4

Oil of Eucalyptus	2 oz.
Liquid Carbolic Acid	4 drops.
Oil of Citronella	2 oz.
Castor Oil	3 oz.

None of these mixtures have been tried by the writer. They are doubtless quite effective, though a certain amount of care should be taken in the use of oil of cassia as it is inclined to cause irritation of the skin.

Some writers recommend that washing of the hands and face be entirely dispensed with when using " fly dope " and thus in time, especially with " dopes " having a large percentage of oil of tar, a protective glaze is formed over the skin. It is doubtful, however, if many skins would stand this treatment without injury, and with most individuals it is necessary to remove the " dope " at night with soap and warm water in order that the skin may be enabled to stand its continuous application throughout the day. If a fly-proof shelter is available this should always be done.

Liquid " dope " should always be carried in a small aluminium flask or screw top tin and never in a glass bottle. The reason for this becomes very obvious after one has broken a bottle of " dope " in his pocket.

Remedies for Mosquito Bites

The most satisfactory remedial substances known to the writer through personal experience are household ammonia and tincture of iodine. Others recommend glycerin or alcohol. Doctor Howard states that he has found ordinary toilet soap most useful. This is moistened and rubbed gently over the puncture after which the irritation soon passes away.

Sprays for Cabins and Tents

During recent years a number of proprietary sprays, designed for the control of houseflies, have been placed on the market. Nearly all of these are of great assistance in banishing mosquitoes, black-flies and " punkies " from a tent or cabin. If used in a tent the front flaps should be closed and the fly curtain dropped. A few puffs from the sprayer directed toward the top of the tent, will kill or stupefy the insects within a few minutes. The front flaps can then be thrown back, when the odour of the spray will soon pass out through the fly curtain and, if the latter is in the proper condition, no further annoyance from insects will be suffered. When the sprays are used in a cabin the door and windows should be closed during and for several minutes after the spraying. The windows, which, of course, should be covered with fine-mesh mosquito bar during the fly season, can then be opened, when the odour of the spray will soon disappear. If the cabin roof is tight and the walls well chinked, few insects will gain access to the building for several hours.

A number of fire rangers and prospectors, whose work takes them into the bush during the height of the fly season, have been interviewed as to their opinion of the value of these preparations as a means of prevention of insect attack. Without exception, these men have stated that a supply of one of these sprays is second in importance only to a fly-proof tent. The writer's own experience indicates a similar conclusion, and all persons entering the bush during the fly season are strongly urged to procure a quantity of some such spray. The sprays are used in an ordinary, small, cheap hand sprayer such as may be obtained at any hardware or seed store.

Though most of the proprietary sprays on the market are good, they are quite expensive and an equally effective, and much cheaper one can easily be made by the individual.

Twinn and Herman, in *A Cheap and Effective Fly Spray,* Scientific Agriculture, Vol. VIII, No. 7, March, 1928, recommend the following:

For Farm Buildings

Pyrethrum ½ pound.
Ordinary Kerosene 1 gallon.

For Household Use

Pyrethrum ½ pound.
Water-white Kerosene 1 gallon.
Methyl salicylate 3 fluid ounces (approximately).

This is prepared by adding the pyrethrum to the kerosene, allowing the mixture to stand and agitating it at intervals over a period of about two hours, thus ensuring that practically all the active principal of the pyrethrum is dissolved. The residue of the pyrethrum settles to the bottom of the vessel as a brown sediment and the clear liquid, which is pale lemon-yellow in colour, may be either siphoned or filtered off.

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